



Appl. No.: 10/565,311
Applicant: Barbara Pause
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Examiner: Jennifer A. Steele
Confirmation No.: 7382

RULE 1.132 DECLARATION OF DR. BARBARA PAUSE

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Commissioner:

I, Barbara H. Pause, declare as follows:

1. I am over the age of 21, have never been convicted of a felony or any crime of moral turpitude and am competent to make this declaration.
2. I am the sole inventor named in U.S. Patent Application Serial No. 10/565,311 ("the Application") which is the subject of this declaration.
3. I hold a Master Degree in Physics from the University of Leipzig, Germany and a Ph.D. Degree in Engineering Science from the University of Wuppertal, Germany.
4. I have been working in the field of material research and development for over 30 years. Specifically, I have been actively involved on the development of the Phase Change Material technology and related products for 15 years. I started researching this subject when I served as an assistant professor at the Technical

University of Leipzig, Germany. In 1997, I joined Outlast Technologies, Inc. based in Boulder Colorado, as Vice President Research & Development where I continued doing research and development work in the field of the Phase Change Material Technology. In May 2000, I founded my own company Textile Testing & Innovation, LLC.. The company specializes in the transfer of cutting-edge technologies, such as phase change material (PCM)-technology, into textiles and polymers that can be used in various end-use products. Currently, I am president and principal researcher of Textile Testing & Innovation, LLC.

5 I am the author of the specification, the claims as amended and all other disclosures of the Application. I am also familiar with Worley et al. U.S. Patent Application No. 2003/0054141 ("Worley"), Zuckerman et al. U.S. Patent No. 6,660,667 ("Zuckerman") and Holdridge et al. U.S. Patent No.4,462,390 ("Holdridge") which have been applied by the Examiner to reject the claims for obviousness.

6. Worley teaches that a polymeric phase change material may be capable of cross-linking in order to increase its toughness or its resistance to heat, moisture and chemicals. The crystalline alkyl hydrocarbons and the salt hydrate phase change materials used in the Application are not capable of cross-linking themselves into a polymer. However, in order to prevent dissolution while in their liquid stages and to contain them in the polymer, these phase change materials need to be embedded in a polymeric structure which is cross-linked around them. Therefore, the use of a cross-linking agent is crucial. The phase change materials need to be applied to the system while in their liquid stage, in order to occupy the maximum possible space within the structure. If they would be applied in a solid stage, the cross-linked structure around them would later rupture due to the expansion in volume during the melting process.

For instance, the commonly used crystalline alkyl hydrocarbon Eicosane melts at about 36 °C. In its solid stage below 36 °C, the phase change material Eicosane

possesses a density of 856 kg/m³. The density of the liquid phase change material Eicosane totals 778 kg/m³. Because of the lower density in its liquid stage, the material expands during melting and, therefore, requires a higher volume within the structure when it becomes liquid. This expansion process can rupture the elastomeric matrix cross-linked around the phase change material and the material will leak out of the structure. If the phase change material is applied to the elastomeric structure in a liquid stage during manufacturing, the liquid phase change material will claim the maximum possible space within the structure and not rupture the matrix when it melts. The same findings have been obtained for salt hydrate phase change materials such as Lithium Nitrate Trihydrate which melts at about 30 °C. The density of the salt hydrate phase change material Lithium Nitrate Trihydrate in its solid stage totals 1550 kg/m³. After melting the materials density decreases to 1430 kg/m³.

7. Worley does not teach a change in translucency when the phase change material changes from solid into its liquid state during absorption of heat. The elastomeric compound without color pigments utilized in the article described in the Application is transparent. The phase change materials used in the Application show an opaque to white color when in their solid stage. When they melt all of them become transparent too. The phase change material cross-linked into the elastomer creates a continuum within the elastomeric structure. Because of the continuous distribution of the phase change material within the elastomeric material, the light transmission of the whole coating layer changes when this phase change occurs.

8. Worley teaches that the polymer may be capable of cross-linking in order to increase its toughness or its resistance to heat, moisture and chemicals. Furthermore Worley teaches that after the polymeric blend has been applied to the substrate the polymers cross-linking feature is used to bond to the substrate (0058). However, Worley does not teach that the cross-linking feature is used to

embed the phase change material into the polymer structure and to prevent the dissolution of the phase change material while in its liquid stage in this way.

In addition, Worley teaches a separate containment structure that encapsulates, contains, surrounds, absorbs or reacts with the phase change material. This containment structure may serve to reduce or prevent leakage of the phase change material from the coated article during end use (0043). In the present application no separate containment structure is used in addition to the polymer.

The prevention of leakage is the major problem for utilizing the phase change material technology. Therefore, most of the textile products currently in the market have extra containments such as microcapsules filled with crystalline alkyl hydrocarbons incorporated into a coating compound which is then applied to a textile carrier (Zuckerman). The microcapsules which contain the crystalline alkyl hydrocarbons can be seen as another form of pigments which are easily to apply to many different compounds. In the present Application, the use of extra containments of the phase change material is avoided by cross-linking the phase change material into the elastomeric structure, i.e. the elastomer is cross-linked around the phase change material. The elastomeric structure acts like a closed container which holds the phase change material and prevents that the phase change material disappears while in its liquid stage. The cross-linking feature is not disclosed in the art of Worley


9. Furthermore, in the art of the Application, cross-linking the elastomeric material around the phase change material does not lead to the changes in the molecular weight or the chain structure of the elastomeric material taught by Worley ((0052).

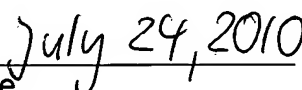
Despite the cross-linking of the elastomeric structure around the phase change material, there is no chemical bond between the elastomer and the phase change material, i.e. the phase change material exists in the matrix separated

from the elastomeric compound. Therefore, the addition of the phase change material does not change the molecular weight or the chain structure of the elastomeric materials. This is evident when the phase change material is in its solid stage where the phase change material is visible in the form of pieces of chunks or even particles in a transparent elastomeric compound..

10. In summary, the major differences between the art of the Application to the art of Worley are the cross-linking of the phase change material into the elastomeric structure and the application of the phase change material in a liquid state during the manufacturing of the coating.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that all these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this declaration is directed.


Barbara H. Pause


Date